Center Independent Research & Development: GSFC IRAD

A Distributed Science Mission Testbed

Completed Technology Project (2016 - 2017)

Project Introduction

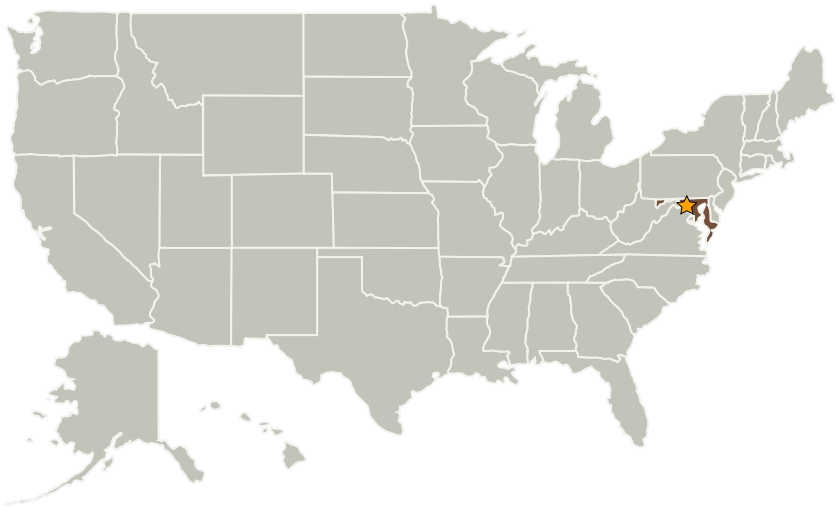
The technology required for distributed spacecraft missions (DSM) is currently hamstrung by the lack of a realistic six-degree-of-freedom (DOF) testing platform. A spacecraft emulator using autonomous rotorcraft provides this capability with minimum investment. Modifying commercially available rotorcraft hardware and applying customized attitude and position control algorithms will result in a space-like testing environment for formation flying, astrometric alignment, and other DSM applications.

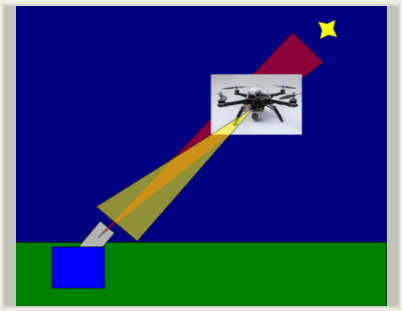
The largest roadblock to advancing distributed spacecraft mission (DSM) technology is the difficulty inherent in demonstrating these concepts in a relevant environment. The complications and expenses required by space-bound technology demonstrations impose onerous costs on budding technologies. Developing an inexpensive test platform that is dynamically similar to the space environment provides an accelerator for a wide range of DSM concepts relevant to all of Goddard's science communities. For example, heliophysics and astrophysics scientists can test coronagraph and virtual telescope concepts like CANYVAL-X, while Earth science principal investigators (PI) can test formations such as MMS or the proposed BOWTIE concept.

Anticipated Benefits

Some future NASA mission concepts rely on the use of distributed systems to make a coordinated science observations. To understand the complexities of distributed systems, a 6 degree of freedom platform would be useful.

Primary U.S. Work Locations and Key Partners





Concept of Operation showing how to use a rotorcraft to demonstrate a distributed spacecraft mission

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Project Transitions

October 2016: Project Start

September 2017: Closed out

Closeout Summary: The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services.Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry.The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies.If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. http://techport.nasa.gov/help

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

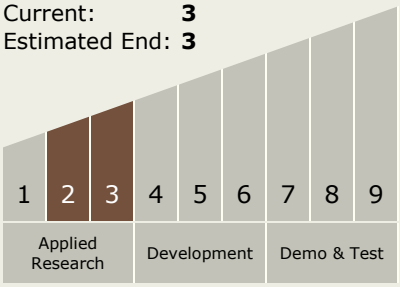
Jason W Mitchell
Michael A Johnson

Principal Investigator:

Neerav Shah

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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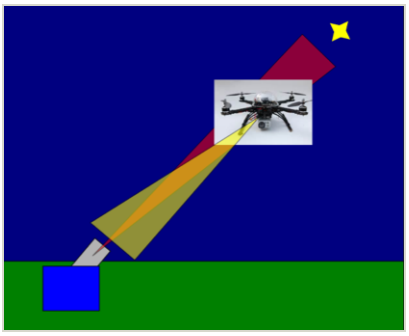
Images



DSM Rotorcraft Test Concept
Concept of Operation showing how to use a rotorcraft to demonstrate a distributed spacecraft mission
(https://techport.nasa.gov/image/26366)

Project Website:

http://aetd.gsfc.nasa.gov/

Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.5 GN&C Systems Engineering Technologies
    - TX17.5.4 GN&C Ground Testbeds/Test Facilities

Other/Cross-cutting:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.5 GN&C Systems Engineering Technologies
    - TX17.5.1 GN&C System Architectures, Requirements and Specifications
    - TX17.5.3 GN&C Verification & Validation Tools & Techniques

Target Destination

Foundational Knowledge